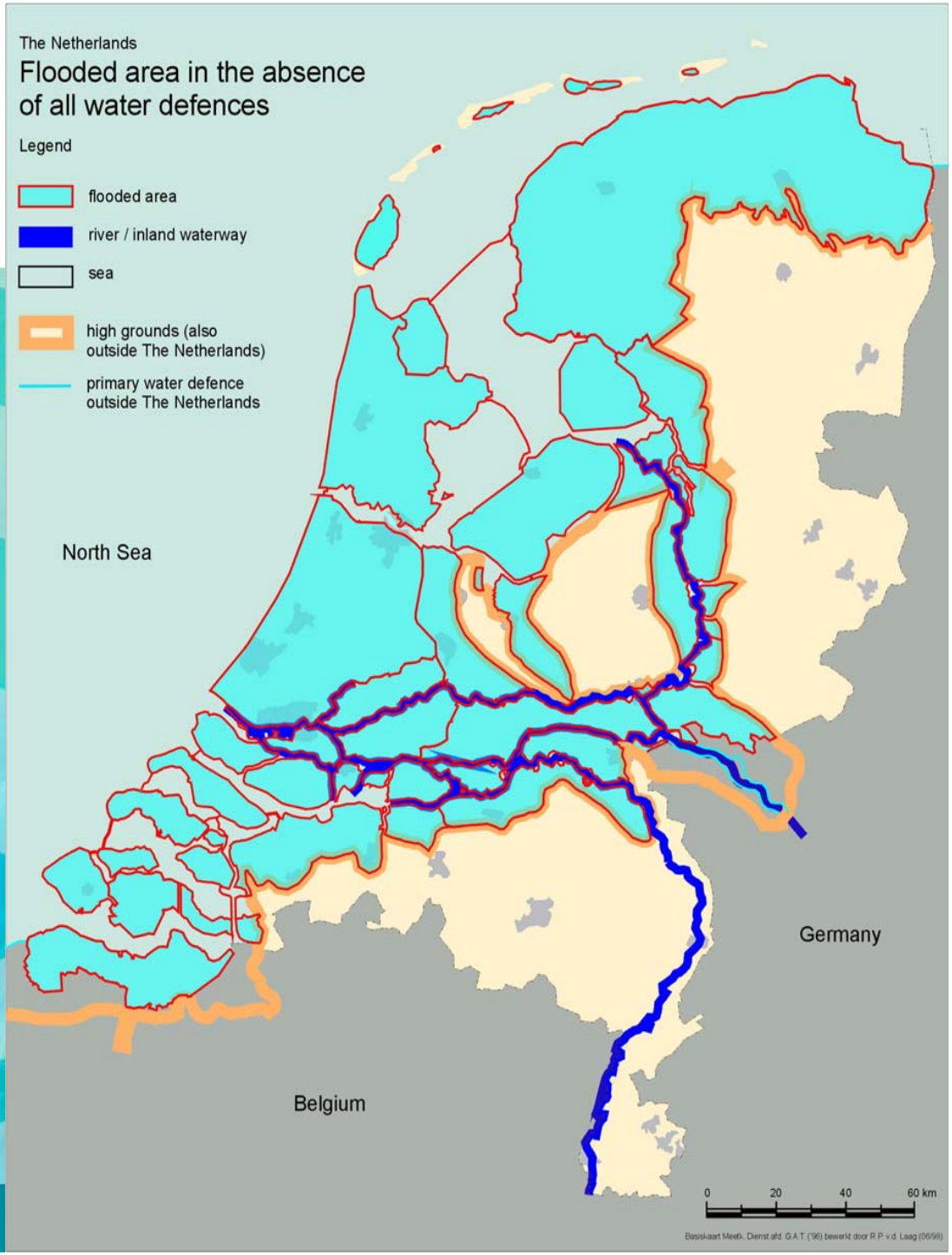
Ministerie van Verkeer en Waterstaat

Rijkswaterstaat

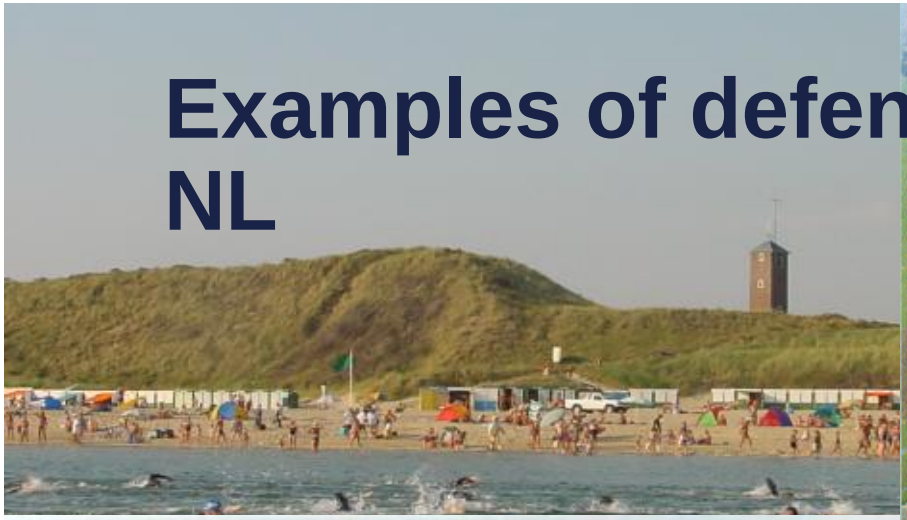
Determining hydraulic design criteria for flood defences

Contents

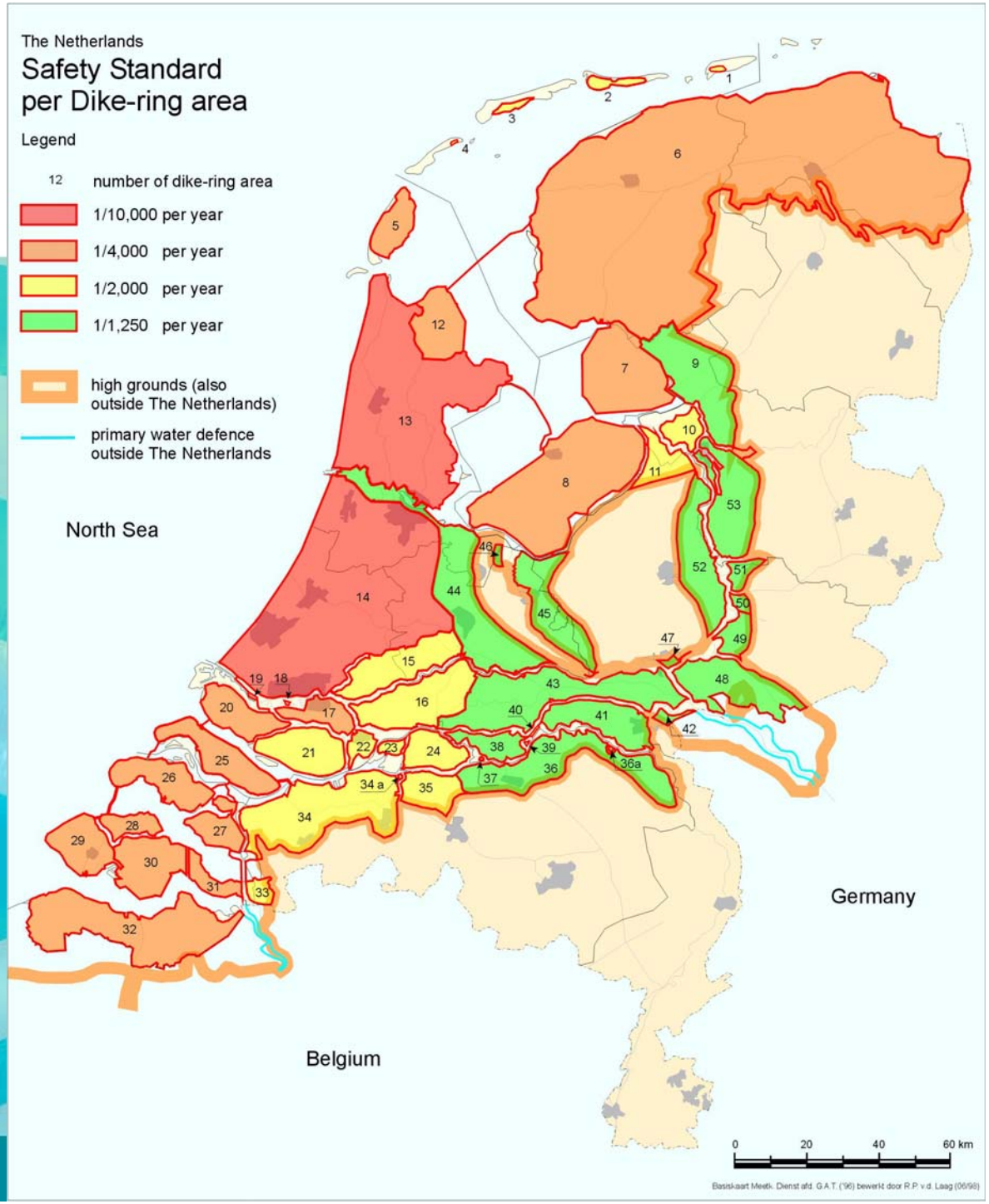
Flooded area in the absence of all flood defences



Examples of defence systems in NL

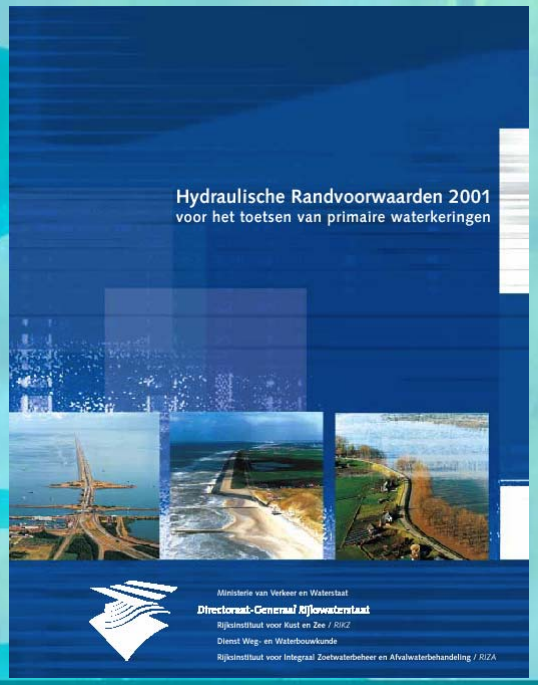


Safety standards



Safety assessment

- prescribed by Flood Defence Act
- performed each 5 years
- performed by water boards
- minister informs parliament
- Hydraulic Boundary Conditions give the required hydraulic information



Hydraulic Boundary Conditions

consists of water levels and waves

based on statistics about

- River discharge
- Wind speed and wind direction
- Sea level during storm surges
- Lake level
- Failure chances of storm surge barriers

and using hydraulic and probabilistic models (Hydra)

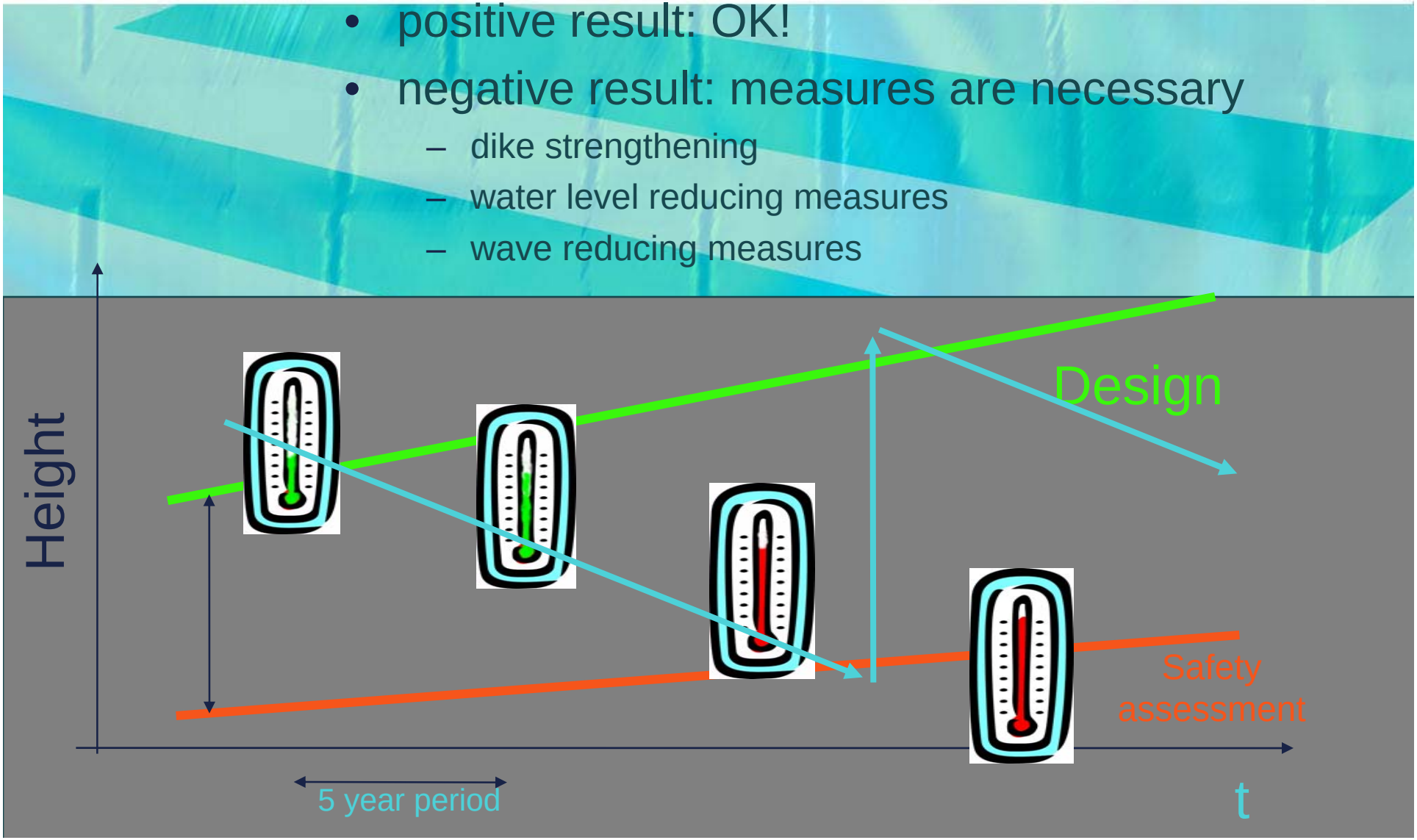
Hydraulic Boundary Conditions are dependent on safety standard

Hydraulic Boundary Conditions

- renewed each 5 years
- based on actual data
  - Extended series discharges, storm surge data
  - Actual geometrical data, vegetation data, etc.
- using newest, broad accepted insights in modelling the physical processes
- developed by Rijkswaterstaat (in cooperation with the water boards)

Assessment results

- positive result: OK!
- negative result: measures are necessary
  - dike strengthening
  - water level reducing measures
  - wave reducing measures



Dike strengthening in the Netherlands

- Dike should last for 50-100 years
- Solid design instead of minimal design
- No legislation available
- Design hydraulic conditions are the responsibilty of the water boards

Design conditions ≠ Hydraulic Boundary Conditions (1)

- climate change
  - river discharges — 18000 m3/s (now 16000 m3/s)
  - increased sea-level rise — 35-85 cm/century
  - wind — +10% (space reservation)
- new insights in physical processes
  - hydraulic and probabilistic modelling
  - extended series for statistical extrapolation

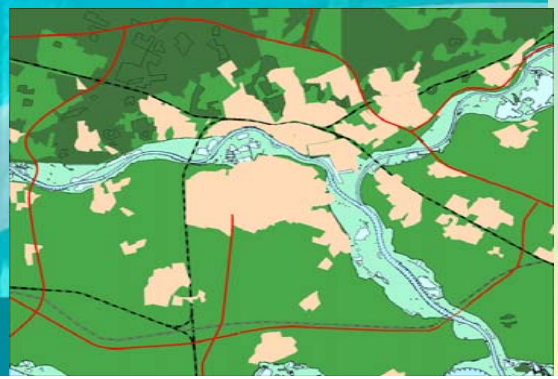
Design conditions ≠ Hydraulic Boundary Conditions (2)

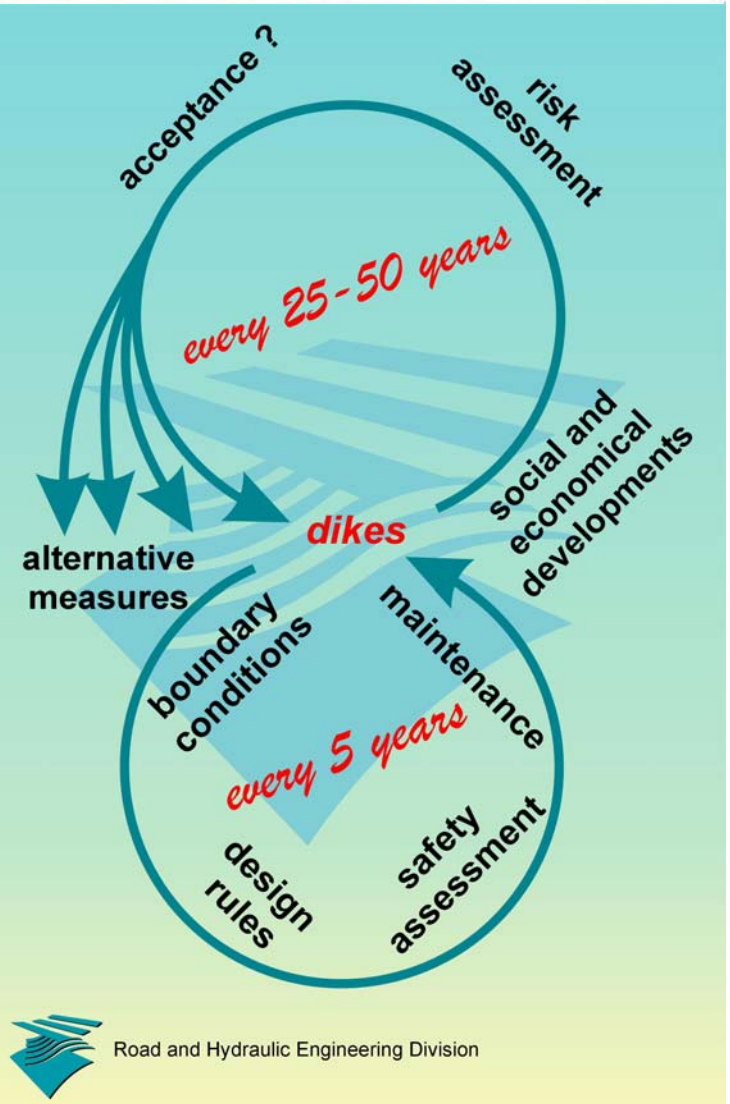
- autonomous changes
  - morphological changes along the coast
  - summerbed lowering in rivers
  - growing vegetation in the flood plains
- man-induced changes
  - Room for the River-project for the Rhine
  - Sand deposits along coastline

Design conditions ≠ Hydraulic Boundary Conditions (3)

- evaluation of the safety policy
  - economical evaluation may change safety standards
  - transition to dike-ring approach

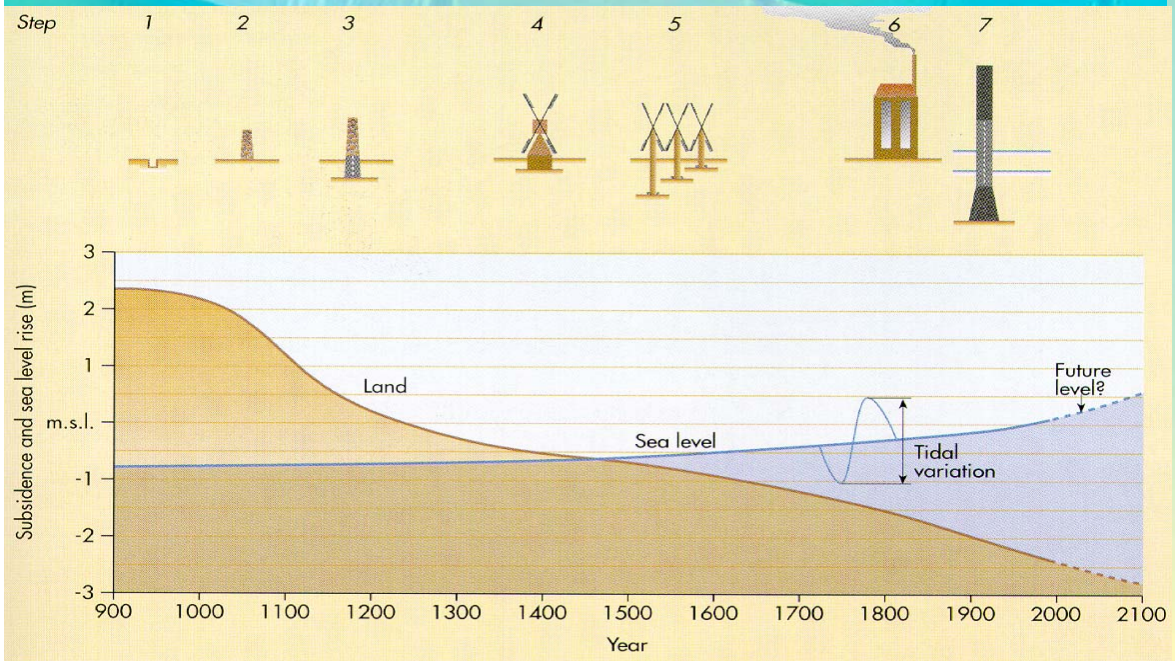
1830 City of Arnhem today

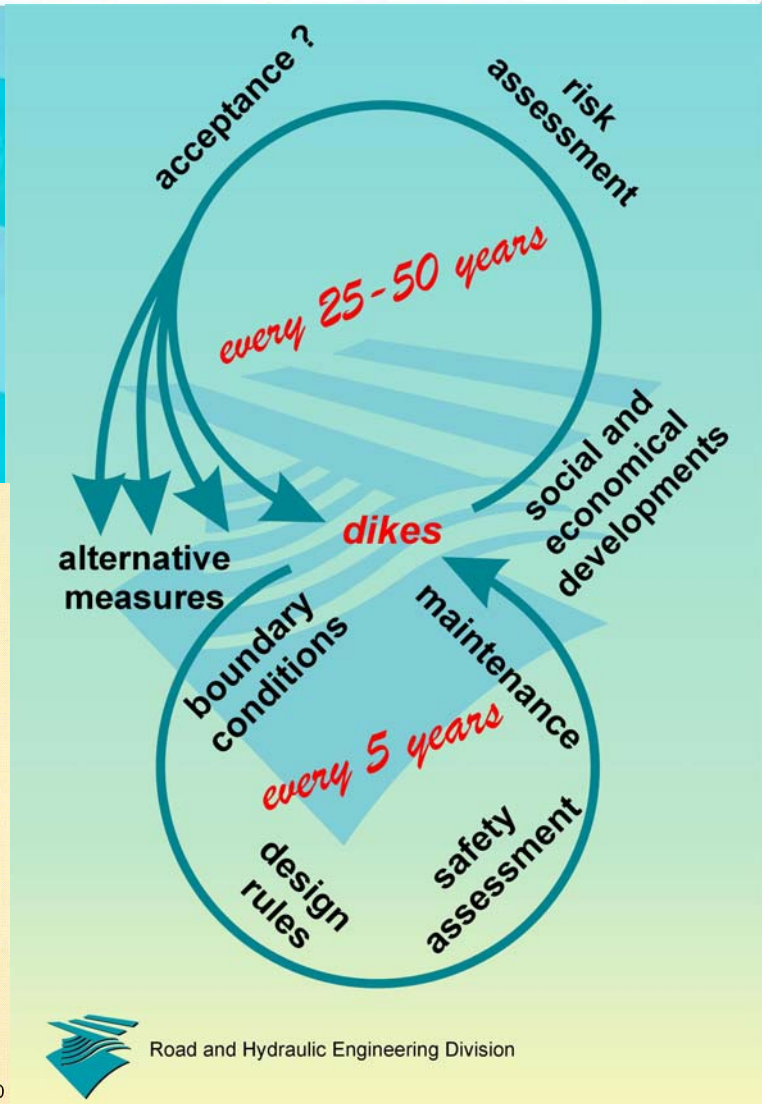




Design conditions ≠ Hydraulic Boundary Conditions (3)

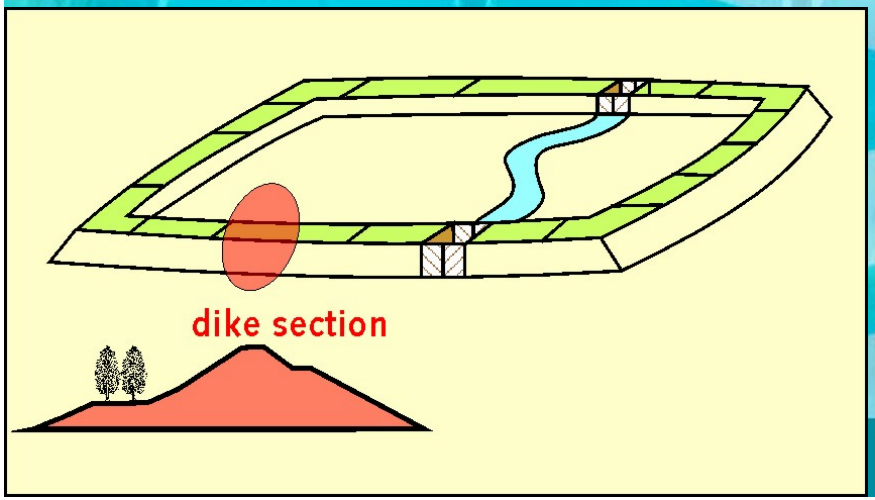
- evaluation of the safety policy
  - economical evaluation may change safety standards
  - transition to dike-ring approach

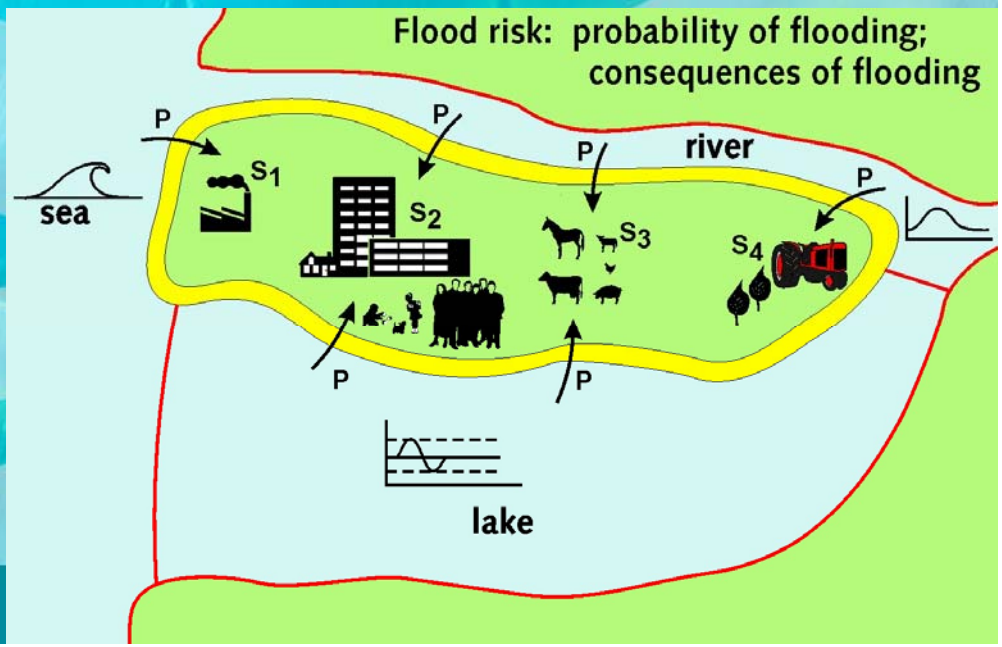




Design conditions ≠ Hydraulic Boundary Conditions (3)

- evaluation of the safety policy
  - economical evaluation may ge safety standards
  - transition to dike-ring approach (flood probability or flood risk)





Conclusions

- 5-yearly safety assessment is performed using actual hydraulic boundary conditions
- In the Netherlands the design conditions are determined by waterboards
- An integrated concept for determining design conditions is being developed